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INSTRUCTION MANUAL

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REGULATED POWER SUPPLIES

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INSTRUCTION MANUAL

OVER/UNDERVOLTAGE AND
OVER/UNDERCURRENT
PROTECTOR

MODEL VIP 3

SERIAL NO. .....

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SECTION I - INTRODUCTION

1-1 SCOPE OF MANUAL

1-2 This instruction manual contains information for the installation, operation and maintenance of the Kepco Model VIP-3 OVER AND UNDER-VOLTAGE/OVER AND UNDER-CURRENT PROTECTOR.

1-3 GENERAL DESCRIPTION

1-4 The Kepco Model VIP-3 is an accessory device to be used in conjunction with DC power supplies to protect external loads from over and under voltages or over and under-currents which can develop as the result of a malfunction in the power supply or the load circuitry. When the Model VIP-3 is triggered by either an over-or under fault condition it instantaneously "crow-bars" the power supply and operates an internal relay, the contacts of which will shut down the input to the power supply if the latter is directly connected to the VIP-3. The relay contacts are also available at the rear for the purpose of operating an external heavy contactor or circuit breaker, should the input rating of the power supply exceed the specifications for the Model VIP-3. (Refer to paragraph 1-6)

1-5 The Model VIP-3 may be connected to operate with any power supply which has a DC output rating and AC input power within the specifications given in paragraph 1-6 below and which is capable of withstanding the application of a short circuit.

1-6 SPECIFICATIONS, ELECTRICAL

a) Input: 105 to 125 V or 210 to 250 V AC, 45 to 400 Hz, single phase; Input current approximately 0.1 A rms (unloaded)

b) Power Supply Outlet (rear): The AC input current of the power supply to be used must not be greater than 10 A rms. If it is greater, an external contactor or circuit breaker must be used, which must remove the power supply from the power line within 50 milliseconds.

c) Maximum Short Circuit Current (of power supply to be used): 30 A DC.

d) Voltage Operation

1) Range: Power supplies with output voltage up to 200 V DC can be accomodated. The range of the VIP-3 is adjustable in four steps: 0-50 V*, 50-100 V, 100-150 V, 150-200 V.

*Minimum operating voltage is approximately 5 V DC.

[illegible]

[illegible]

) Range: Power supplies with output current ratings up to [illegible] can be accommodated.

, Sensitivity: 5% of the operating current, if this current produces a 1 volt drop across an external sensing resistor.

Response Time:

1) Shunting across the output of the connected power supply (crow-baring) occurs within 50 μ sec after triggering.

2) Input power is removed from connected power supply approximately 50 m sec. after triggering. (If external contactor or circuit breaker is used, its response time must be added to the 50 m sec

SPECIFICATIONS, PHYSICAL

a) Dimensions: Height 3 1/2", Width 19", Depth 11" (over-all behind panel)

b) Finish: Light gray per federal standard: 595 Color #26440.

c) Mounting: Panel fits standard 19" rack.

SECTION II - INSTALLATION

2-1 UNPACKING AND INSPECTION

2-2 The Kepco Model VIP-3 OVER AND UNDER-VOLTAGE/OVER AND UNDER-CURRENT Protector has been completely tested and inspected at the factory prior to packing and is ready for installation and operation. It should be unpacked with reasonable care and inspected for shipping damages. Notify the responsible carrier if any evidence of such damage exists.

2-3 TERMINALS AND CONTROLS (Refer to FIG'S 2-1 and 2-2, also TABLES 2-1 and 2-2)

a) Front Panel Controls and Terminations.

1) POWER SWITCH; "ON-OFF" toggle switch, controlling AC input power to the VIP-3.

2) FUSE; Protects VIP-3 circuitry only. Opening of this fuse, or setting POWER SWITCH (1) to "off" position, will release the internal power relay and shut off the connected power supply. (As will <u>any</u> momentary or permanent removal of line power from the VIP-3)

3) OPERATE LIGHT. White pilot light indicates VIP-3 in operating mode. The rear power receptacle is energized.

4) FAULT LIGHT. Red pilot light indicates fault condition, VIP-3 has triggered. Will remain on as long as fault condition persists and unit is not reset.

5) OPERATING VOLTAGE, COARSE. Control for setting the VIP-3 to the operating voltage of the connected power supply in steps of 50 volts.

6) OPERATING VOLTAGE, FINE. Continuous adjustment of operating voltage within any of the four ranges of the coarse control (5).

7) DISABLE SWITCH. Three position switch. Neutral in the "off" position. Disables the internal relay and crow-bar circuit in the "fixed" or "momentary" disabling position for purposes of set-up and readjustment.

8) DC POWER SUPPLY CONNECTIONS. Labeled binding posts for connecting power supply to VIP-3.

9) THRESHOLD-OVER/UNDER. Two separate controls, continuously adjustable for setting triggering threshold above or below the operating voltage of the power supply.

b) Rear Terminations.

1) REAR BARRIER-STRIP. Eleven terminal barrier strip containing additional set of DC power supply connections, parallel to the front terminals, and terminals for special operating procedures. (Refer to Section III of this manual.)

2) POWER RECEPTACLE. Standard parallel blade receptacle with center connector connected to the chassis. Power supplies with input currents to 10 A rms may be connected to this relay controlled outlet.

3) ALARM RECEPTACLE. Two prong miniature outlet, energized through the built-in relay with 115 V AC when FAULT LIGHT is on.

4) INPUT LINE CORD. Three wire safety line cord supplies power to the VIP-3 and to power supply if connected to the POWER RECEPTACLE.

2-4 OPERATION ON OTHER THAN STANDARD POWER LINE

2-5 The Model VIP-3 is normally supplied for operation on a 105 to 125 V AC, 45 to 400 Hz, single phase line. To operate on 210 to 250 V AC, locate transformer T1 (Refer to FIG. 5-2) and remove bare wire jumpers between terminals (1)-(2) and (3)-(4) on the printed circuit board. Connect jumper between terminals (2) and (3). Do not remove any other wires. Proceed in reverse order for reconversion to 105-125 V AC operation.

2-6 GROUNDING

a) AC Ground. The VIP-3 is equipped with a 3 wire safety line cord and polarized plug. The third (green) wire in the line cord is connected to the chassis and the case of the unit. If a two terminal receptacle in combination with an adaptor is used, it is imperative that the chassis of the VIP-3 be returned to AC ground with a separate lead.

b) DC Ground. All DC input terminals are isolated from ground.

NOTE: It is important that the ground potential between the power supply ground and the VIP-3 ground is as small as possible to prevent spurious triggering of the device due to ground pick-up. If possible, a common ground lead should be constructed, connecting both units together and then leading to a good ground.

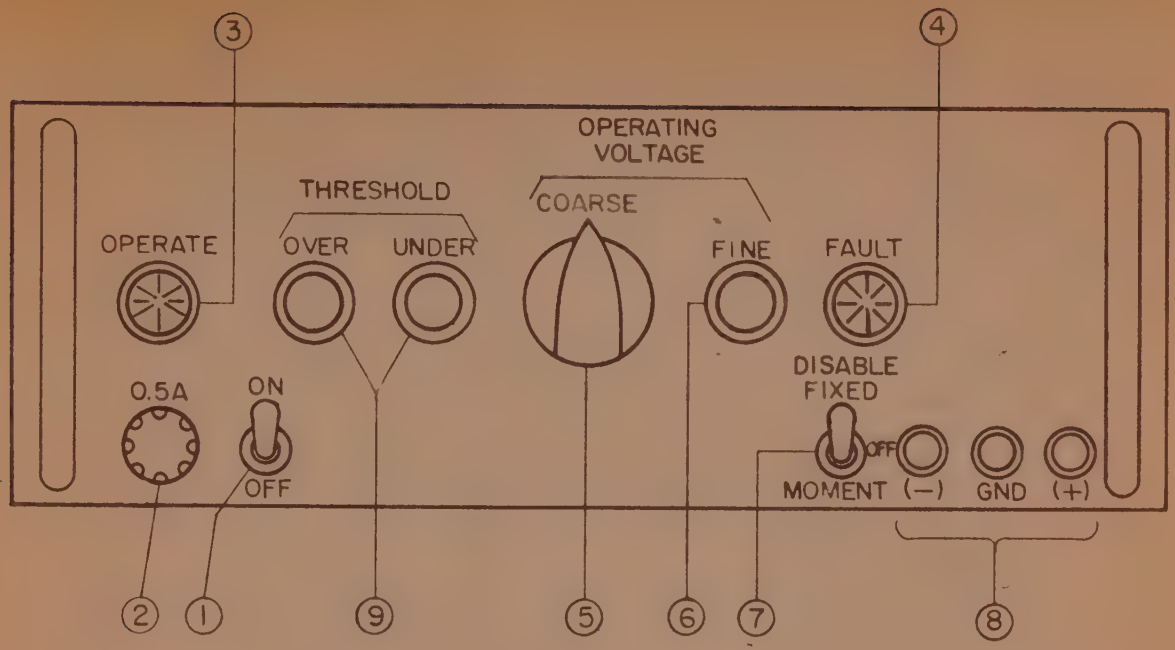


FIG. 2-1 FRONT PANEL TERMINATIONS AND CONTROLS

No.	Control or Termination (see par. 2-3 for functions)
1	AC Power Switch
2	Fuse, 0.8 A
3	Operate Light
4	Fault Light
5	Operating Voltage, Coarse
6	Operating Voltage, Fine
7	Disable Switch
8	DC Power Supply Connections
9	Threshold, OVER and UNDER

TABLE 2-1 FRONT PANEL TERMINATIONS AND CONTROLS

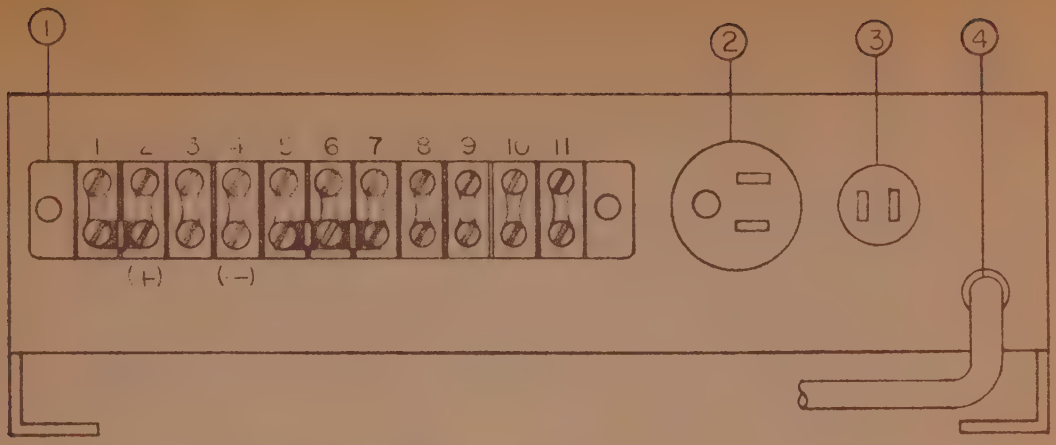


FIG. 2-2 REAR TERMINATIONS

No.	Termination (see par. 2-3 for functions)
1	REAR BARRIER STRIP with TERMINALS: (1) Internal Voltage Control Resistors } Link Normally (2) Plus (+) terminal } Between (1) and (2) (3) Ground (chassis) (4) Minus terminal (5) "OVER" amplifier } Normally linked together. "Under" or "Over" (6) Comparison Bridge } threshold may be inhibited by opening (7) "UNDER" amplifier } respective link and connecting (5) or (7) to terminal (4). (8) Current Sensing Input Terminal (9)-(10) Parallel terminals to the Panel "DISABLE SWITCH" for remote connection of additional dissabling device. (11) No connection
2	Power Receptacle
3	Alarm Outlet
4	Input Line Cord

TABLE 2-2 REAR TERMINATIONS

SECTION III - OPERATING PROCEDURES

3-1 GENERAL

3-2 The Kepco Model VIP-3 Over-Under Voltage/Over-Under Current Protector is shipped with removable jumper links on the rear barrier strip, between terminals (1)-(2) and (5)-(6)-(7). (Refer to FIG. 2-2) These links must be in place and secured tightly for standard over voltage-under voltage operation of the VIP-3, as described below.

3-3 STANDARD OVER/UNDER VOLTAGE OPERATION

3-4 Description. In this mode of operation, the Model VIP-3 is set to trigger at a preselected value from the power supply output voltage. The operation is perhaps best described by means of an example. The desired operating voltage of a power supply is 24 V DC. An over or under voltage of 1 volt (guard band ±1 V) shall crow-bar the power supply.

3-5 PROCEDURE (Refer to FIG. 3-1)

a) Set Controls on VIP-3 as follows:

1) AC POWER SWITCH "OFF".

2) OPERATING VOLTAGE, COARSE to position "0-50V"

3) OPERATING VOLTAGE, FINE "fully clockwise"

4) THRESHOLD, OVER to approximately 90% of its fully clockwise position.

5) THRESHOLD, UNDER to "fully counter clockwise".

6) DISABLE SWITCH to "fixed disabled".

b) Connect the operating set-up as shown in FIG. 3-1.

c) Turn AC POWER SWITCH on the VIP-3 "on". The white OPERATE light should be on, the red FAULT light should be out and the power supply will be on if its power switch was in the "on" position. (If not, turn power supply on.)

d) Set power supply to the desired operating voltage plus 1 volt (25 V). Slowly turn OPERATING VOLTAGE FINE control counter clockwise until FAULT light goes just on.

e) Set the OVER THRESHOLD by turning control counter clockwise until FAULT light goes out again. Check over threshold by raising the power supply voltage. If over threshold is not sufficient, back off slightly on OVER THRESHOLD control until desired threshold voltage is achieved.

f) Set power supply to 23 volts output. Set the UNDER THRESHOLD by turning control clockwise until the red FAULT light goes on. Back off on the control until the FAULT light goes out again.

g) Check the guard band, achieved by the above described set-up of the OVER AND UNDER THRESHOLD controls. Vary power supply voltage ±1 volt from 24 V to see if VIP-3 FAULT light goes out at the guard band limits.

h) Connect load by closing the load switch. Set DIABLE switch to the "off" position. The Model VIP-3 is now set-up and ready to operate. Any over or under voltage in excess of the set guard band (±1 volt) will trigger the VIP-3 and shut down the power supply.

3-6 TRACKING OPERATION

3-7 Description. In this mode of operation, the VIP-3 is connected directly into the sensing circuit of the power supply and detects error voltages resulting from internal defects of the supply. A defect, (such as shorted pass transistors) will cause an unbalance of the sensing circuit which, as an error signal will trigger the VIP-3. Any defects in the bridge circuit however, such as an open Rvc, shorted Rr or a change in the reference voltage will also be tracked by the V.I.P. and the V.I.P. will not provide protection.

3-8 The tracking method is specifically designed for use with Kepco feedback regulated power supplies or units of similar design where the error signal at the sensing circuit terminals is virtually zero at balance and which use the <u>negative terminal</u> as their common lead. (PNP pass-elements).

3-9 PROCEDURE (Refer to Fig. 3-2)

a) Remove links on the rear barrier-strip of the Model VIP-3 between terminals (5)-(6)-(7). Connect terminals (5) and (7) to the null junction of the power supply as shown. Set both, OVER and UNDER threshold control to their maximum clockwise position. Set DISABLE switch to the "fixed" position.

b) Turn power supply and VIP-3 "on". The operating set up is now complete. Any malfunction in the power supply will trigger the VIP-3 and crow-bar the power supply. To test the operating set-up, proceed as described in par. 3-9C.

b) Open load circuit and shut off AC power to the VIP-3 and the power supply. Connect a voltmeter across the output of the power supply (supply #2) across the output of the primary supply (supply #1.) Turn on VIP-3 and both power supplies. Increase voltage of supply #2 beyond that of supply #1 and note the triggering point of the VIP-3 on the monitoring voltmeter. This point may now be varied from the previous set maximum sensitivity to the threshold level desired.

c) Check the under voltage point by overloading the power supply, provided the supply features a current limit circuit. Shut power "off".

d) Reconnect load, remove supply #2 and set DISABLE switch to the "off" position. The VIP-3 is now ready to operate.

3-10 OVER/UNDER CURRENT OPERATION

3-11 Description. In this operating mode the Model VIP-3 senses a small voltage drop across a resistance placed in series with the DC load current which the power supply delivers to the load. The voltage across the "sensing resistor" is proportional to the load current and is used as an error signal to trigger the VIP-3 in the event of an OVER or UNDER CURRENT. The sensing resistor should be of such a value as to drop approximately 1.0 volt at the desired operating current. It should preferably be built as a four terminal network and must have sufficient power rating to exclude thermal drift.

3-12 PROCEDURE (Refer to FIG. 3-3)

a) Remove link on barrier-strip between terminals (1)-(2). Connect operating set-up as shown in FIG. 3-3 using a substitute load in place of the actual load.

b) Set the DISABLE switch to the FIXED position and adjust the OVER and UNDER THRESHOLD controls to their approximate mid positions. The operating voltage COARSE control should be set to a range which will cover the output voltage range of the supply. The FINE control must be set to its maximum counterclockwise position.

c) Connect an ammeter in series with the load.

d) Turn on both the VIP and power supply (in that order) and advance the power supply current control to the normal operating current. Turn the FINE voltage adjust clock wise until the FAULT light goes out. If difficulty is experienced in extinguishing the FAULT light, turn the OVER and UNDER THRESHOLD controls slightly in the counterclockwise direction until the FAULT light goes out. At this point we can proceed to set-up the under and over THRESHOLD levels.

e) The lower THRESHOLD level can be adjusted by first setting the output current of the supply to the desired current level, then vary the UNDER THRESHOLD control until a point is found that by slight rotation in either direction of the FINE control will either ignite or extinguish the FAULT light. Set the UNDER THRESHOLD control to the point which just ignites the fault light.

f) The upper threshold level can be adjusted in the same manner, by setting the output current of the supply to the desired level and adjusting the OVER THRESHOLD control.

NOTE: Due to the interaction between the THRESHOLD and FINE VOLTAGE adjust controls, some manipulations may be required in setting up the threshold band.

g) After the THRESHOLD levels have been adjusted, return the output current of the power supply to its normal operating current.

h) Connect actual operating load. The Model VIP-3 will be ready for operation once the DISABLE switch is placed in the OFF position.

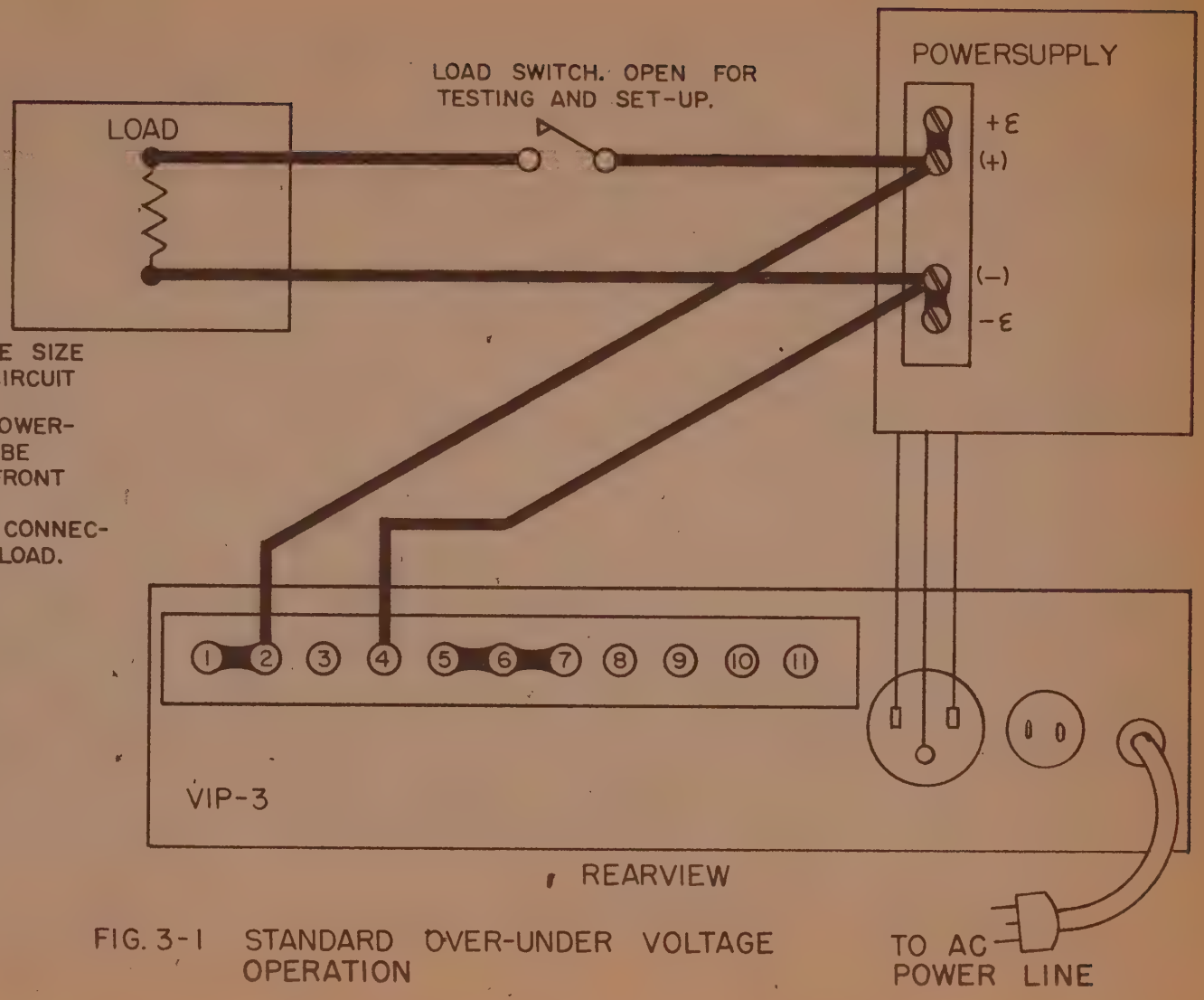
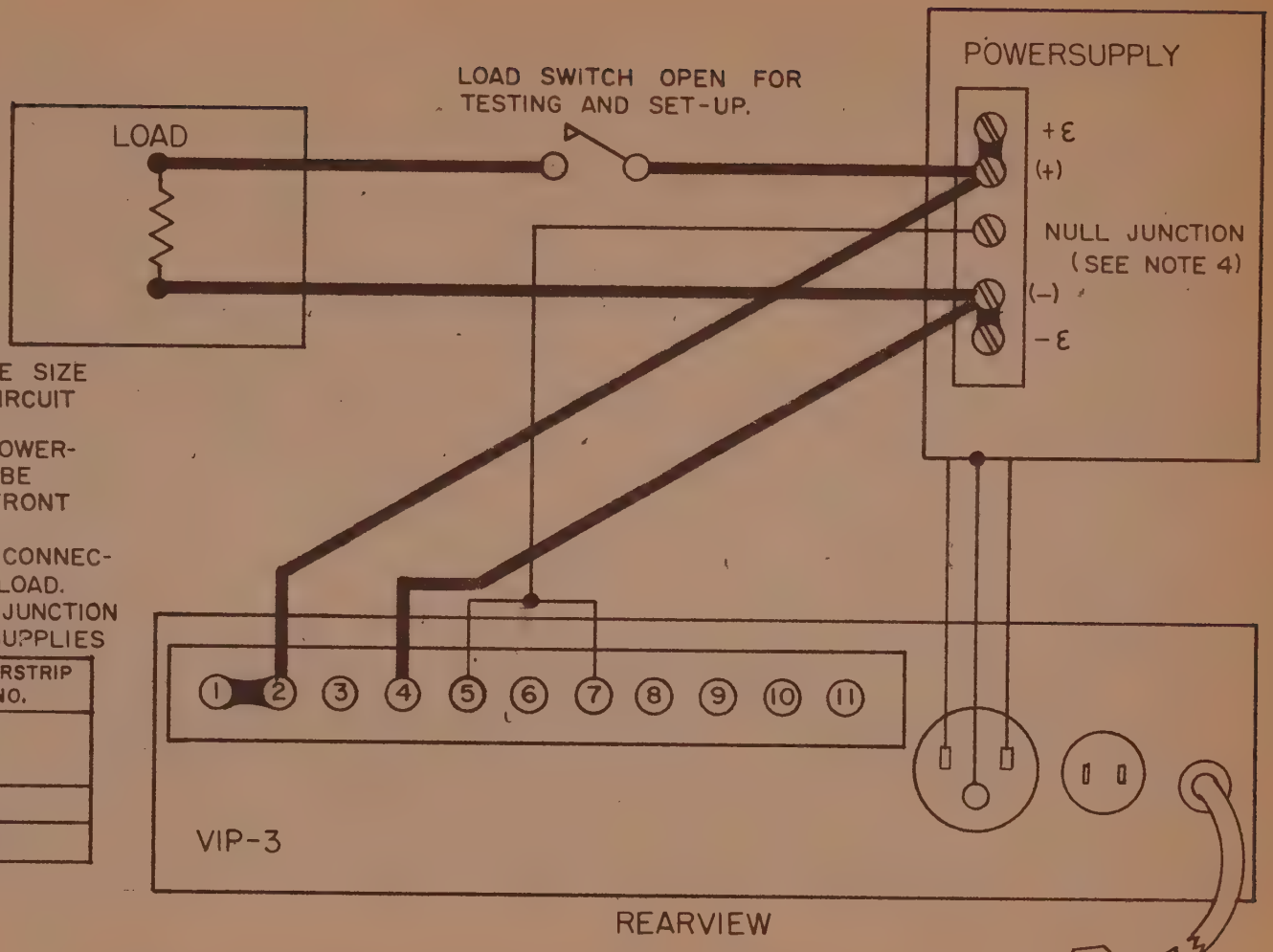

LOAD SWITCH. OPEN FOR TESTING AND SET-UP.
LOAD
POWERSUPPLY
+ε
(+)
(−)
−ε
NOTES:
1) USE ADEQUATE WIRE SIZE TO CARRY SHORT-CIRCUIT CURRENT.
2) CONNECTIONS TO POWER-SUPPLY MAY ALSO BE MADE FROM THE FRONT PANEL OF VIP.
3) VIP MAY ALSO BE CONNECTED DIRECTLY TO LOAD.
1 2 3 4 5 6 7 8 9 10 11
VIP-3
REARVIEW
TO AC POWER LINE

FIG. 3-1 STANDARD OVER-UNDER VOLTAGE OPERATION



NOTES:
1) USE ADEQUATE WIRE SIZE TO CARRY SHORT-CIRCUIT CURRENT.
2) CONNECTIONS TO POWER-SUPPLY MAY ALSO BE MADE FROM THE FRONT PANEL OF VIP.
3) VIP MAY ALSO BE CONNECTED DIRECTLY TO LOAD.
4) LOCATION OF NULL-JUNCTION FOR KEPCO POWERSUPPLIES

MODEL	REAR-BARRIERSTRIP TERMINAL NO.
ABC(ALLTRANSISTOR)	9
CK	12
KS	12

FIG. 3-2 CONNECTION FOR TRACKING MODE OPERATION

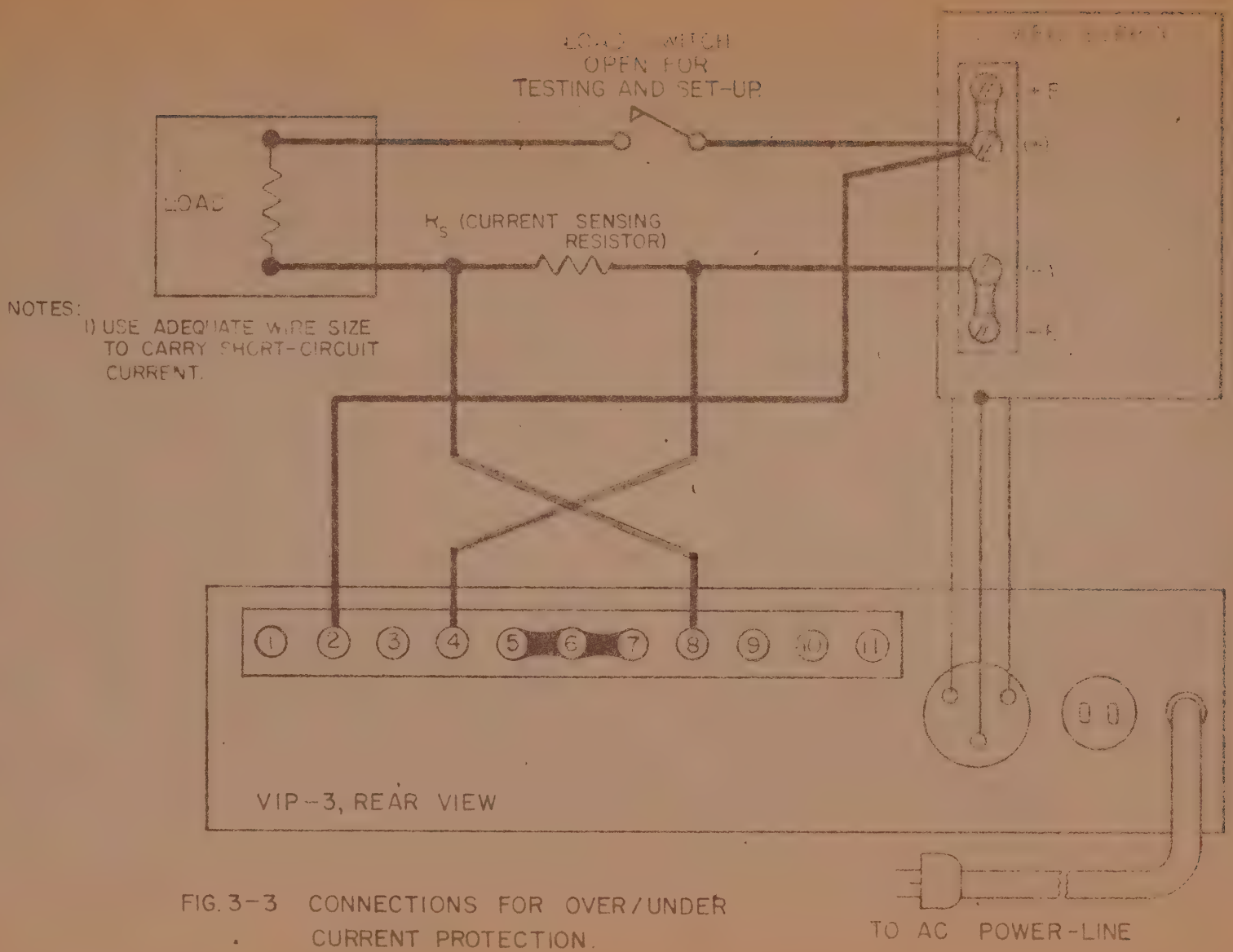


FIG. 3-3 CONNECTIONS FOR OVER/UNDER CURRENT PROTECTION.

SECTION IV - CIRCUIT DESCRIPTION

4-1 GENERAL

4-2 This section describes the major circuitry of the Kepco Model VIP-3 OVER AND UNDER VOLTAGE/OVER AND UNDER CURRENT PROTECTOR. The purpose of the analysis is to provide the user with a functional understanding of the equipment, thus forming a basis for successful operation and maintenance.

4-3 AC INPUT CIRCUIT (Refer to Main Schematic, FIG. 5-3)

4-4 AC line power is introduced through a heavy duty, three wire line cord with polarized plug. When line power switch S101 is closed, line power is applied to main transformer T1. As the secondary voltage builds up, relay K201 is energized through diodes CR1, CR2 and capacitor C5 and held by its own holding contacts (1) and (3). The power supply outlet (J202) as well as the "Operate" pilot light (DS101) are energized.

4-5 MAIN DC SUPPLIES. (Refer to Main Schematic, FIG. 5-3)

4-6 The operating voltages for the two amplifier circuits and the control bridge circuit are derived from the secondary winding on T1. Two full-wave rectifier circuits comprised by CR1 through CR4 and two capacitor filters provide the DC operating voltages, which are zener regulated by CR5 and CR6.

4-7 BRIDGE SENSING CIRCUIT (Refer to FIG. 4-1)

4-8 In the over/under voltage operating mode, use is made of a voltage comparison bridge circuit. This bridge is formed by the voltage drop across R102 (V_r), by R15 and R18 (R_r), by the "coarse" and "fine" voltage control resistors (R_{vc}), and the output voltage of the power supply to which the VIP-3 is connected (E_{in}). A condition of balance exists when $\frac{V_r}{R_r} = \frac{E_{in}}{R_{vc}}$. In this case the error voltage between points A and A' is virtually zero. The balance is upset however as soon as there is a change in E_{in}. The unbalance appears as an error signal at the input to the OVER AND UNDER differential amplifier stages. Depending on the polarity of the error signal, it will be amplified by one of the amplifiers and directed to the gate of the crow-baring S.C.R.

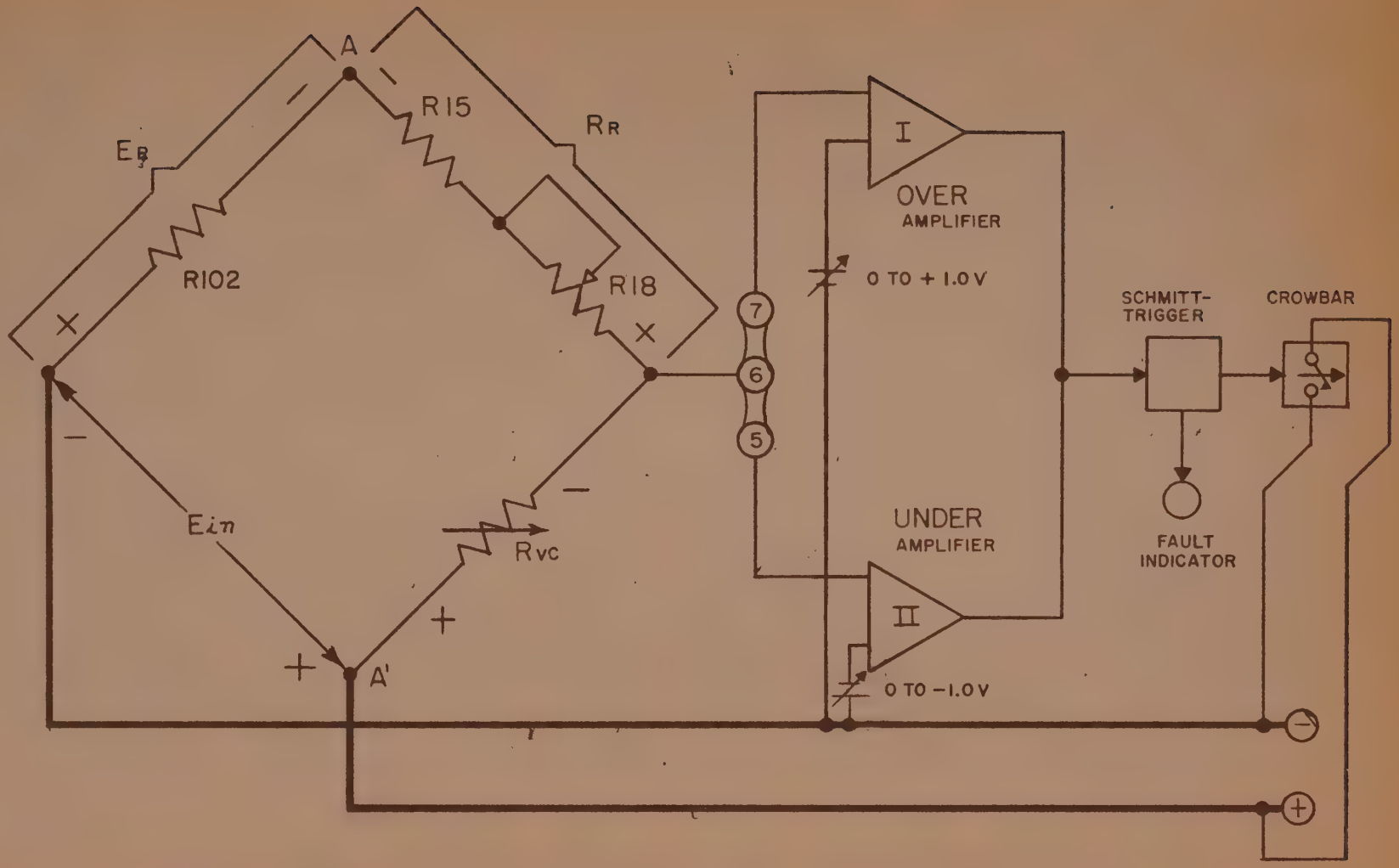


FIG. 4-1 SIMPLIFIED BLOCK DIAGRAM AND BRIDGE CIRCUIT, VIP-3

4-9 AMPLIFIER AND CROWBAR CIRCUITRY

4-10 The input circuitry of the VIP-3 is comprised of the differential input pairs Q1 and Q2 and Q3-Q4 for the OVER and UNDER amplifiers respectively. Both input stages are equipped with offset controls (R101,102), brought out to the front panel (OVER and UNDER THRESHOLD) while simultaneously being connected to the null junction of the sensing bridge. An arbitrary error signal, larger than the adjusted threshold (in either OVER or UNDER amplifier) will be amplified and transfered to Q5 in the case of the UNDER amplifier and from there after 180° phase shift to the Schmitt-Trigger, Q6 and Q7 which when activated applies a gate turn-on signal to silicon controlled rectifier CR9. In the OVER amplifier the signal from the differential input pair is fed to the Schmitt-Trigger directly. CR9 when fired, places a short circuit across rear barrier-strip terminals (2) and (4) and the front panel input terminals which are in parallel. In series with the short circuit are resistors R28 through R32 and diode CR8. The resistances are proportional to the setting of the OPERATING VOLTAGE - COARSE switch on the front panel. Their purpose is to limit the short circuit current through CR9.

4-11 The above described sequence of events takes place with the DISABLE switch in the "off" position. In the "fixed" or "momentary" dissable position, the sequence differs in the following respects:

a) The gate and cathode of the crow-bar S.C.R. (CR9) are shorted out a and CR9 can consequently not be triggered. The Schmitt-Trigger output is only directed to the base of Q8, which when turned "on", will activate the red FAULT light (DS102).

b) K201 will not be energized since no current is flowing through CR7. Also, the power supply outlet (J202) will stay energized and the alarm outlet (J203) will not be energized.

SECTION V - MAINTENANCE

5-1 GENERAL

5-2 This section contains information for the maintenance, internal adjustments and trouble shooting of the KEPCO Model VIP-3 OVER-UNDER VOLTAGE/OVER-UNDER CURRENT PROTECTOR. Functional tests are described in conjunction with the operational procedures in Section III.

5-3 PRECAUTIONS

5-4 No parts in this device should be replaced with substitutes not specified in the parts list (Section VI). No adjustments or circuit changes must be made other than those described in this section. Replacements or adjustments made without understanding the effects may cause serious damage to the device.

5-5 TEST EQUIPMENT REQUIRED

5-6 The following is a list of test equipment required to test and adjust the Model VIP-3.

a) Variable transformer capable of adjusting the powerline from either 105 to 125 V AC or 210 to 250 V AC, to test the Model VIP-3 over its specified input range.

b) Power supply, feedback regulated, output voltage range 0 to 200 volts KEPCO Model SM 325-0.5 or its equivalent. (Two are required if the VIP-3 is to be tested in the Overcurrent mode of operation.

c) Voltage Monitor, differential or digital voltmeter with a resolution of at least 10 mV and a range covering the maximum operating range of the Model VIP-3. DIGITEC Model 201 or its equivalent.

d) Multimeter, Weston Analyzer, Model 980 or its equivalent, for general trouble-shooting and voltage measurements.

5-7 INTERNAL BRIDGE CURRENT ADJUSTMENT

5-8 The internal adjustment for the comparison bridge current is factory adjusted to a value that allows the Model VIP-3 to accommodate power

supplies up to and including 200 volts output voltage with the OPERATING VOLTAGE "COARSE" and "FINE" controls on the front panel turned completely clockwise. The adjustment of the internal bridge current control is necessary only following replacement of the control and /or its' associated components.

5-9 PROCEDURE

a) Connect power supply and digital or differential voltmeter across the rear terminals on the VIP-3 (2) and (4). Set DISABLE switch to FIXED. Set OVER THRESHOLD and both, OPERATING VOLTAGE "COARSE" AND "FINE" controls to their maximum clockwise position. Set under Threshold Control to its maximum counter-clockwise position.

b) Turn the Model VIP-3 on first. Turn on power supply and set to exactly 205 volts output.

c) If the Model VIP-3 has triggered while the power supply was advanced to 205 volts turn R18 (Refer to FIG. 5-2 for location) counter clockwise and repeat paragraph 5-9B.

d) If Model VIP-3 does not trigger when reaching 205 volts on the power supply adjust R18 clockwise until triggering just occurs as indicated by the lighting of the red FAULT light. This concludes the adjustment.

5-10 TROUBLE SHOOTING

5-11 Modern solid state devices require thourough understanding of the problem involved in repairing complex feedback circuitry. Servicing beyond simple part replacements should consequently be attempted only by personnel thoroughly familiar with solid state component techniques and with experience in closed loop circuitry.

5-12 "Trouble shooting charts", showing resistance and voltage readings in various parts of the circuitry are of very limited usefulness with feedback amplifiers and are not included here. Presented instead are a detailed circuit description (Section IV), parts location diagrams (FIG'S. 5-1 and 5-2) and the main schematic (FIG. 5-3) with all significant voltage readings.

5-13 The following basic steps in case of a malfunction may be found useful:

a) Device does not function at all: Check all power line connections

and make certain that fuses are intact and device is connected to the correct line voltage. (It is normally delivered for 115 V AC operation, if not specified otherwise).

b) If device shows spurious triggering, investigate the ground connections of both, the VIP-3 and the power supply. As indicated in all operational set-up diagrams in Section III, the ground connection should be common to both instruments, as short as possible, and returned to a solid AC ground.

c) A large percentage of field-failures is due to incorrect external connections. Check all external set-ups against the diagrams provided in Section III.

d) Only after points A through C above have been thoroughly covered should an internal analysis begin. The transistors should be checked on a reliable transistor checker. The voltage readings are taken with the DISABLE switch in the "fixed" position and with a 50 volt power supply connected to the VIP-3.

e) KEPCO Field Engineering Offices or the KEPCO Repair Department will be available for consultation or direct help in difficult service or application problems.

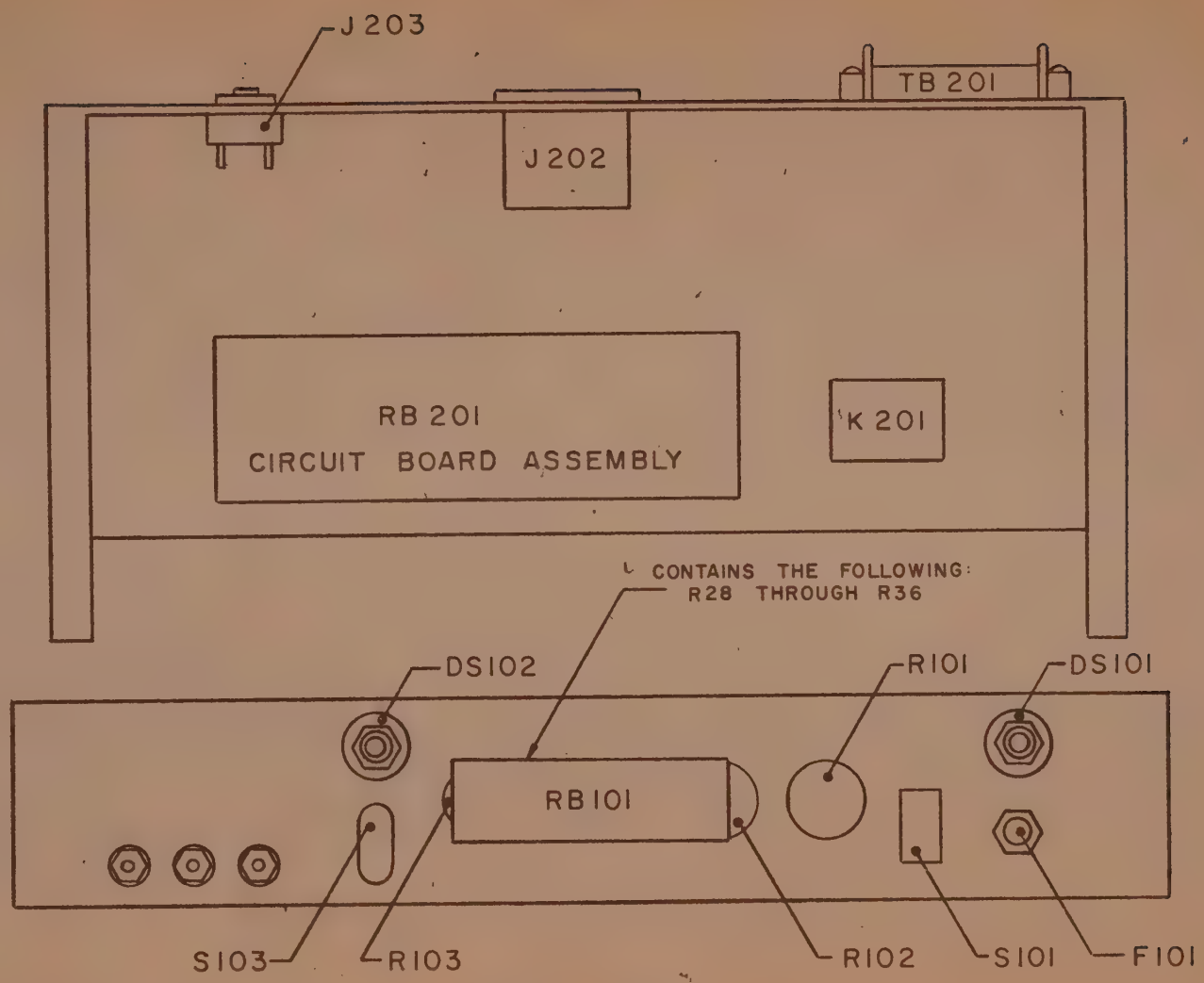


FIG. 5-1 COMPONENT LOCATION (MAIN CHASSIS)

REPLACEMENT PARTS LIST

CONTROL BOARD ASSEMBLY: RB-201 MODEL VIP-3 Code **12-1168**

C1,2	2	Capacitor, Electrolytic, Pigtail 50 µF, 150 V	Industrial Cond. 10B936	117-0127
C3,4	2	Capacitor, Electrolytic, Pigtail 100 µF, 50 V	Industrial Cond. 1B1070	117-0122
C5	1	Capacitor, Electrolytic, Pigtail 20 µF, 150 V	General Electric 43F2271AA2	117-0145
C6,7	2	Capacitor, Mylar 2 µF, 200 V, 10%	TRW Type X663F	117-0129
C8,9,10	3	Capacitor, Mylar 0.05 µF, 200 V, 20%	TRW Type X663F	117-0315
C11,12,13	3	Capacitor, Mylar 0.4 µF, 200 V, 20%	TRW Type X663F	117-0128
C14	1	Capacitor, Electrolytic, Pigtail 50 µF, 12 V	General Electric 43F2769AA1	117-0239
C15	1	Capacitor, Mylar, Pigtail 0.5 µF, 200 V, 20%	Wesco Type 33MM	117-0123
CR1,2,3, 4,7	5	Rectifier, Silicon, Pigtail	Semicon SM 140/S	124-0028
CR5,6	2	Zener Diode	Transitron SV125	121-0028
CR8	1	Rectifier, Silicon, Stud	Mallory 1N3211	124-0164
CR9	1	Rectifier, Silicon, Controlled Stud Type	General Electric C30B	124-0268
CR10,11	2	Rectifier, Silicon, Pigtail	Solitron 124-0178	124-0178
Q1,2,5,6	4	Transistor, NPN	M.S. Transistor 119-0056	119-0056
Q3,4,7	3	Transistor, PNP	Hughes 2N1131A	119-0055
Q8	1	Transistor, PNP	RCA 2N4036	119-0074
R1	1	Resistor, Fixed, Precision, WW 20 K ohm, 1 W, 3%	Tepro TS-1W	115-1240
R2,4,11	3	Resistor, Fixed, Power, Axial 2 K ohm, 5 W, 5%	Ward Leonard 5X2000	115-0568
R5,12	2	Resistor, Fixed, Power, Axial 1 K ohm, 3 W, 5%	Tepro Electric TS-3C	115-1302
R6	1	Resistor, Fixed, Power, Axial 50 ohm, 3 W, 5%	Ward Leonard 3X50	115-0641
R7	1	Resistor, Fixed, Power, Axial 500 ohm, 3 W, 5%	Ward Leonard 3X500	115-0459

REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

[illegible] LISTED FOR [illegible] REPLACEMENT [illegible] ARE SELECTED FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

kepco inc. ®

REPLACEMENT PARTS LIST

CONTROL BOARD ASSEMBLY; RB-201 MODEL VIP-3 Code 11-966

SCHEMATIC NO.	QTY.	DESCRIPTION	MFRS. NAME & PART NO. (See Note)	KEPCO PART NO.
R8,13	2	Resistor,Fixed,Molded 3.3 K ohm, 1/2 W, 10%	Allen Bradley EB3321	115-0439
R10	1	Resistor,Fixed,Power,Axial,WW 550 ohm, 3 W, 5%	Hardwick Hindle 9/16 GA	115-1365
R14	1	Resistor,Fixed,Molded 3.9 K ohm, 1/2 W, 10%	Allen Bradley EB3921	115-0921
R15	1	Resistor,Fixed,Power,Axial 750 ohm, 3 W, 5%	Ward Leonard 3X750	115-0885
R16,17,23	3	Resistor,Fixed,Molded 1 K ohm, 1/2 W, 10%	Allen Bradley EB1021	115-0547
R18	1	Resistor,Variable,Multiturn 500 ohm, 0.25 W, 10%	Bourns 271-1-501 Trimit	115-0663
R19,26	2	Resistor,Fixed,Molded 4.7 K ohm, 1/2 W, 5%	Allen Bradley EB4725	115-0350
R20	1	Resistor,Fixed,Molded 100 K ohm, 1/2 W, 10%	Allen Bradley EB1041	115-0809
R21,24	2	Resistor,Fixed,Molded 12 K ohm, 1/2 W, 5%	Allen Bradley EB1235	115-1341
R22,27,37,38	4	Resistor,Fixed,Molded 2 K ohm, 1/2 W, 5%	Allen Bradley EB2025	115-0520
R25	1	Resistor,Fixed,Molded 6.8 K ohm, 1/2 W, 5%	Allen Bradley EB6825	115-0579
R28,29,30	3	Resistor,Power,Axial 0.25 ohm, 5 W, 5%	Hardwick Hindle 1WA	115-1174
R31,32	2	Resistor,Fixed,Power,Axial 0.5 ohm, 5 W, 5%	Ward Leonard 7/8" Y0.5	115-0781
R33,34,35	3	Resistor,Fixed,Precision 50 K ohm, 1 W, 1%	Wilrite CMC-1	115-0297
R36	1	Resistor,Power,Axial 5 K ohm, 3 W, 5%	Hardwick Hindle 9/16 GA-5000LTC	115-1094
R39	1	Resistor,Fixed,Molded 20 K ohm, 1/2 W, 5%	Allen Bradley EB2035	115-0555
T1	1	Transformer	Kepco Magnetics	100-1346

REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS, REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

REPLACEMENT PARTS LIST

CONTROL BOARD ASSEMBLY; RB-201 MODEL VIP-3 Code 11-966

R8,13	2	Resistor,Fixed,Molded 3.3 K ohm, 1/2 W, 10%	Allen Bradley EB3321	115-0439
R10	1	Resistor,Fixed,Power,Axial,WW 550 ohm, 3 W, 5%	Hardwick Hindle 9/16 GA	115-1365
R14	1	Resistor,Fixed,Molded 3.9 K ohm, 1/2 W, 10%	Allen Bradley EB3921	115-0921
R15	1	Resistor,Fixed,Power,Axial 750 ohm, 3 W, 5%	Ward Leonard 3X750	115-0885
R16,17,23	3	Resistor,Fixed,Molded 1 K ohm, 1/2 W, 10%	Allen Bradley EB1021	115-0547
R18	1	Resistor,Variable,Multiturn 500 ohm, 0.25 W, 10%	Bourns 271-1-501 Trimit	115-0663
R19,26	2	Resistor,Fixed,Molded 4.7 K ohm, 1/2 W, 5%	Allen Bradley EB4725	115-0350
R20	1	Resistor,Fixed,Molded 100 K ohm, 1/2 W, 10%	Allen Bradley EB1041	115-0809
R21,24	2	Resistor,Fixed,Molded 12 K ohm, 1/2 W, 5%	Allen Bradley EB1235	115-1341
R22,27,37, 38	4	Resistor,Fixed,Molded 2 K ohm, 1/2 W, 5%	Allen Bradley EB2025	115-0520
R25	1	Resistor,Fixed,Molded 6.8 K ohm, 1/2 W, 5%	Allen Bradley EB6825	115-0579
R28,29,30	3	Resistor,Power,Axial 0.25 ohm, 5 W, 5%	Hardwick Hindle IWA	115-1174
R31,32	2	Resistor,Fixed,Power,Axial 0.5 ohm, 5 W, 5%	Ward Leonard 7/8" Y0.5	115-0781
R33,34,35	3	Resistor,Fixed,Precision 50 K ohm, 1/4W, 1%	Wirette CMC-1	115-0297
R36	1	Resistor,Power,Axial 5 K ohm, 3 W, 5%	Hardwick Hindle 9/16 GA-5000LTC	115-1094
R39	1	Resistor,Fixed,Molded 20 K ohm, 1/2 W, 5%	Allen Bradley EB2035	115-0555
T1	1	Transformer	Kepco Magnetics	100-1346

[illegible] BOARD ASSEMBLY; RB-201 MODEL VIP-3 Code 11-966

		DESCRIPTION	MFRS. NAME & PART NO. (See Note)	KEPCO PART NO.
R8, [illegible]	[illegible]	Resistor, Fixed, Molded 3.3 K ohm, 1/2 W, 10%	Allen Bradley EB3321	115-0439
[illegible]	1	Resistor, Fixed, Power, Axial, WW 550 ohm, 3 W, 5%	Hardwick Hindle 9/16 GA	115-1365
R14	1	Resistor, Fixed, Molded 3.9 K ohm, 1/2 W, 10%	Allen Bradley EB3921	115-0921
R15	1	Resistor, Fixed, Power, Axial 750 ohm, 3 W, 5%	Ward Leonard 3X750	115-0885
R16, 17, 23	3	Resistor, Fixed, Molded 1 K ohm, 1/2 W, 10%	Allen Bradley EB1021	115-0547
R18	1	Resistor, Variable, Multiturn 500 ohm, 0.25 W, 10%	Bourns 271-1-501 Trimit	115-0663
R19, 26	2	Resistor, Fixed, Molded 4.7 K ohm, 1/2 W, 5%	Allen Bradley EB4725	115-0350
R20	1	Resistor, Fixed, Molded 100 K ohm, 1/2 W, 10%	Allen Bradley EB1041	115-0809
R21, 24	2	Resistor, Fixed, Molded 12 K ohm, 1/2 W, 5%	Allen Bradley EB1235	115-1341
R22, 27, 37, 38	4	Resistor, Fixed, Molded 2 K ohm, 1/2 W, 5%	Allen Bradley EB2025	115-0520
R25	1	Resistor, Fixed, Molded 6.8 K ohm, 1/2 W, 5%	Allen Bradley EB6825	115-0579
R28, 29, 30	3	Resistor, Power, Axial 0.25 ohm, 5 W, 5%	Hardwick Hindle 1WA	115-1174
R31, 32	2	Resistor, Fixed, Power, Axial 0.5 ohm, 5 W, 5%	Ward Leonard 7/8" Y0.5	115-0781
R33, 34, 35	3	Resistor, Fixed, Precision 50 K ohm, 1 W, 1%	Wilrite CMC-1	115-0297
R36	1	Resistor, Power, Axial 5 K ohm, 3 W, 5%	Hardwick Hindle 9/16 GA-5000LTC	115-1094
R39	1	Resistor, Fixed, Molded 20 K ohm, 1/2 W, 5%	Allen Bradley EB2035	115-0555
T1	1	Transformer	Kepco Magnetics	100-1346

REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS NO ONE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAIN-ING PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

FRONT PANEL ASSEMBLY, MODEL VIP-3 Code 11-966

SCHEMATIC NO.	QTY.	DESCRIPTION	MFRS. NAME & PART NO. (See Note)	KEPCO PART NO.
DS101,102	2	Pilot Light, Neon	General Electric NE-51	153-0024
F101	1	Fuse, Slo Blo 0.8 A, 250 V	Bussman MDL-8/10	141-0027
R101,102	2	Resistor,Variable,WW 100 ohm, 4 W, 10%	Clarostat A10-100	115-0425
R103A	1	Resistor,Variable,WW 50 K ohm, 10%	International Resis. WP50000	115-1340*
R103B	1	Resistor,Variable,WW 1 K ohm, 10%	International Resis. WM1000	115-1338*
S101	1	Switch,Toggle DPST, 15 A, 125 V	Carling 2GK-53	127-0010
S102	1	Switch,Rotary DP	Ohmite 111-4T2	127-0158
S103	1	Switch,Toggle SPST, 15 A, 125 V	Cutler-Hammer 8815K6	127-0061

*R103A & R103B assembled together become 115-1339.

MAIN CHASSIS ASSEMBLY INCLUDES:

K201	1	Relay 3PDT	Omega 200PC3CX	140-0040

REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS, REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

REPLACEMENT PARTS LIST

FRONT PANEL ASSEMBLY, MODEL VIP-3 — Code 11-966

SCHEMATIC NO.	QTY.	DESCRIPTION	MFRS. NAME & PART NO. (See Note)	KEPCO PART NO.
DS101,102	2	Pilot Light, Neon	General Electric NE-51	153-0024
F101	1	Fuse, Slo Blo 0.8 A, 250 V	Bussman MDL-8/10	141-0027
R101,102	2	Resistor,Variable,WW 100 ohm, 4 W, 10%	Clarostat A10-100	115-0425
R103A	1	Resistor,Variable,WW 50 K ohm, 10%	International Resis. WP50000	115-1340*
R103B	1	Resistor,Variable,WW 1 K ohm, 10%	International Resis. WM1000	115-1338*
S101	1	Switch,Toggle DPST, 15 A, 125 V	Carling 2GK-53	127-0010
S102	1	Switch,Rotary DP	Ohmite 111-4T2	127-0158
S103	1	Switch,Toggle SPST, 15 A, 125 V	Cutler-Hammer 8815K6	127-0061

*R103A & R103B assembled together become 115-1339.

MAIN CHASSIS ASSEMBLY INCLUDES:

K201	1	Relay 3PDT	Omega 200PC3GX	140-0040

REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

IN PARTS NOT THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AN EXACT AND SPECIFIC ITEM AND IS SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS. WE RETAIN THE RIGHT TO USE EQUIVALENT PARTS. QUALITY AND RELIABILITY ARE ASSURED WHEN ORDERING REPLACEMENT PARTS FROM KEPCO, INC.

SYM. NO.	QTY	DESCRIPTION	MFRS. NAME & PART NO.	KEPCO
DS101		Pilot Light, Neon	General Electric NE-51	153-0024
F10.	1	Fuse, Slo Blo 0.8 A, 250 V	Bussman MDL-8/10	141-0027
R101,102	2	Resistor, Variable, WW 100 ohm, 4 W, 10%	Clarostat A10-100	115-0425
R103A	1	Resistor, Variable, WW 50 K ohm, 10%	International Resis. WP50000	115-1340*
R103B	1	Resistor, Variable, WW 1 K ohm, 10%	International Resis. WM1000	115-1338*
S101	1	Switch, Toggle DPST, 15 A, 125 V	Carling 2GK-53	127-0010
S102	1	Switch, Rotary DP	Ohmite 111-4T2	127-0158
S103	1	Switch, Toggle SPST, 15 A, 125 V	Cutler-Hammer 8815K6	127-0061

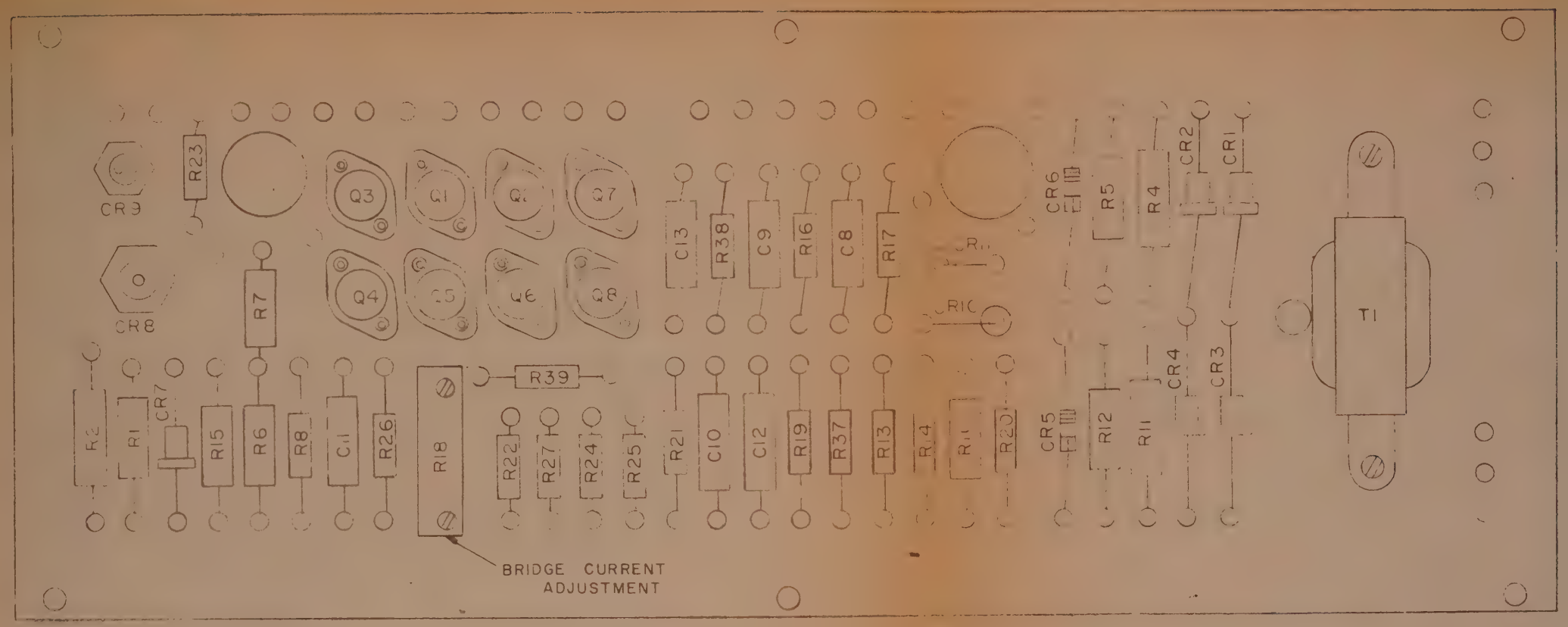
*R103A & R103B assembled together become 115-1339.

MAIN CHASSIS ASSEMBLY INCLUDES:

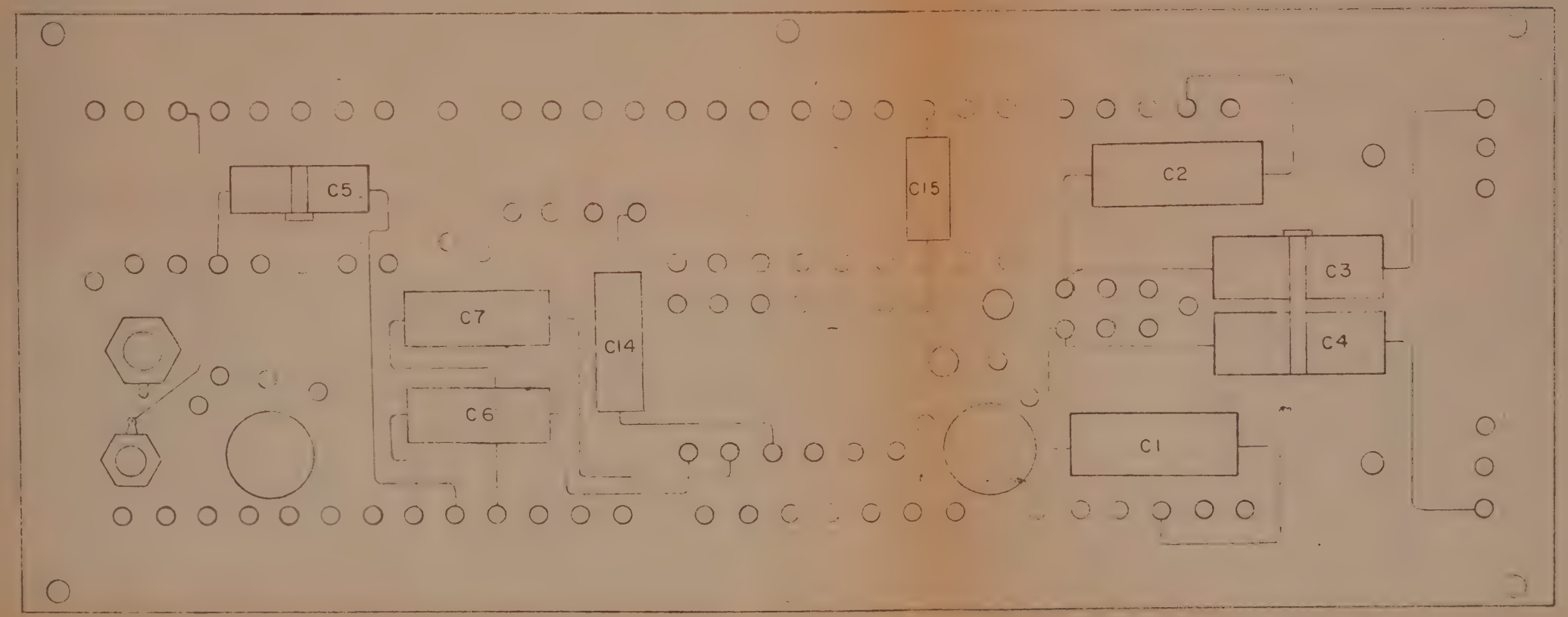
K201	1	Relay 3PDT	Omega 200PC3CX	140-0040

PARTS MAY BE ORDERED FROM KEPCO.

NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS, REPRESENTS SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAIN- PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNA



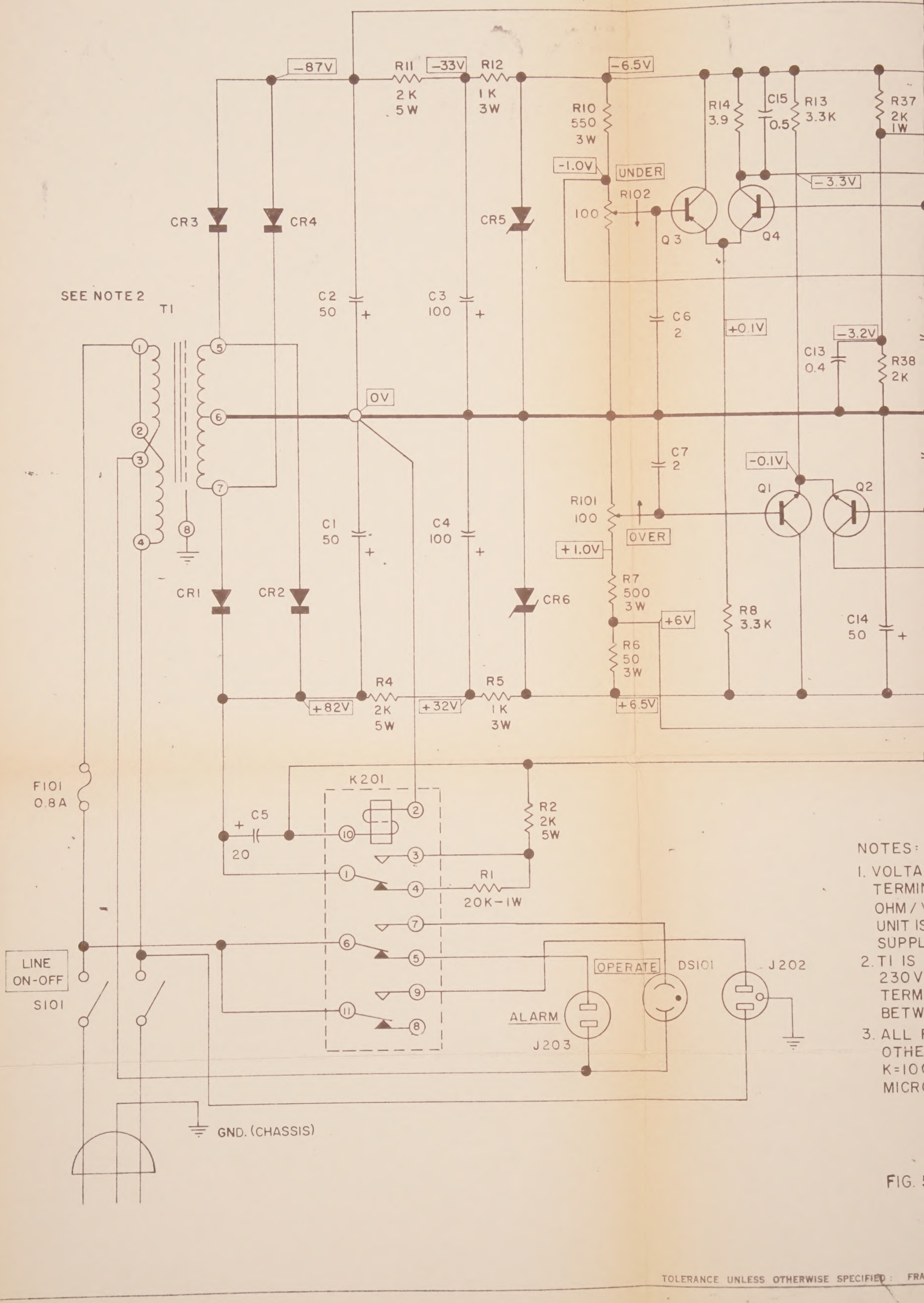
A) TOP VIEW



B) BOTTOM VIEW

KEPCO INC. FLUSHING, N.Y.			
COMPONENT LOCATION RB201			
MK		FIG 5-2	11-15-66
V.I.P.-3		237-0145	
BM06364			

CM02692



NOTES:

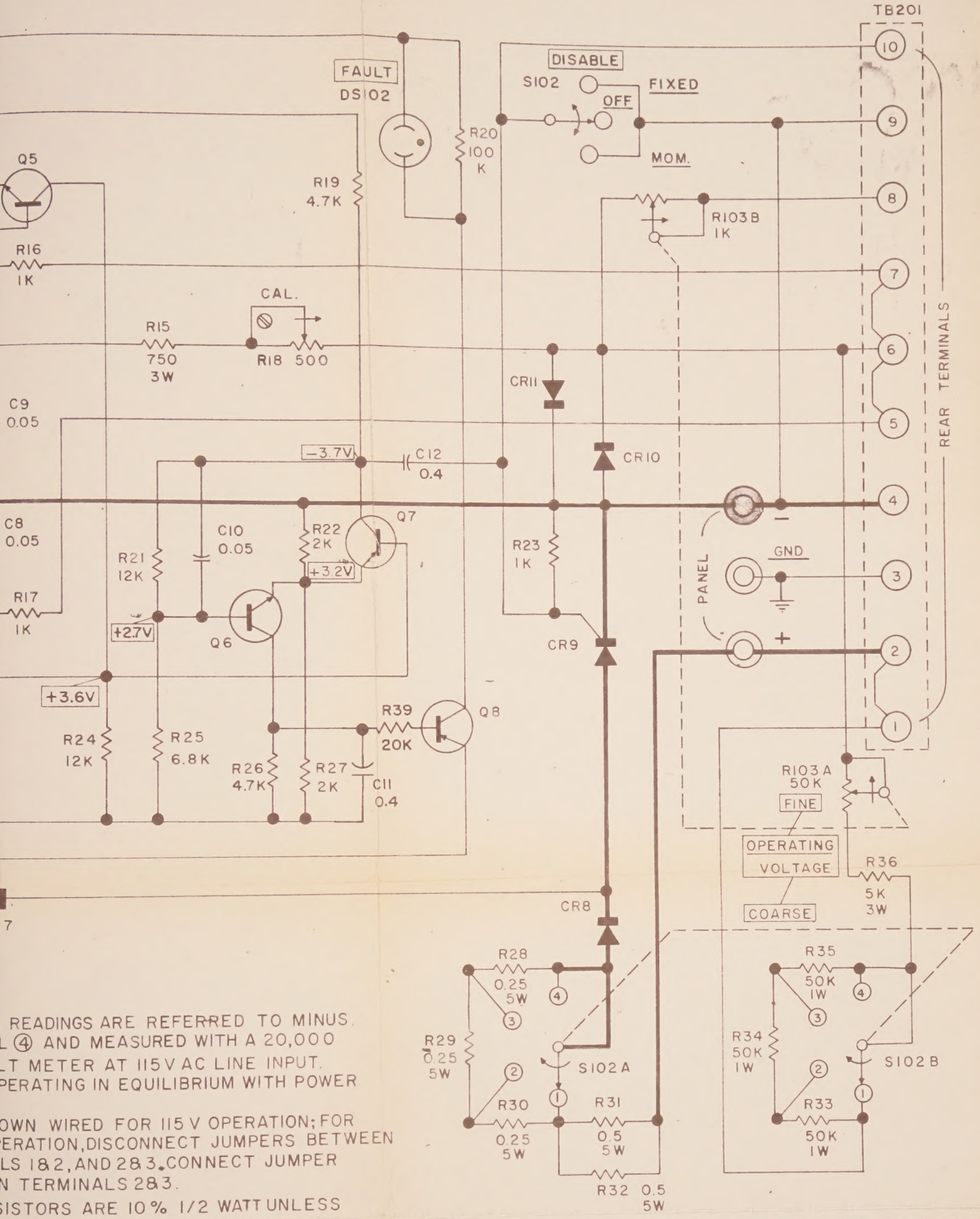
1. VOLTA
   TERMI
   OHM / V
   UNIT IS
   SUPPL
2. T1 IS
   230 V
   TERM
   BETW
3. ALL R
   OTHE
   K=10
   MICR

FIG. 5

TOLERANCE UNLESS OTHERWISE SPECIFIED : FRA

DEFIANCE NO. 1000H

REVISIONS	DRAWN	CHKD.	APPD.	DATE



7

READINGS ARE REFERRED TO MINUS.
L ④ AND MEASURED WITH A 20,000
LT METER AT 115 V AC LINE INPUT.
PERATING IN EQUILIBRIUM WITH POWER

OWN WIRED FOR 115 V OPERATION; FOR
PERATION, DISCONNECT JUMPERS BETWEEN
LS 1&2, AND 2&3. CONNECT JUMPER
N TERMINALS 2&3.

SISTORS ARE 10% 1/2 WATT UNLESS
ISE SPECIFIED. VALUES IN OHMS,
OHMS. ALL CAPACITOR VALUES IN
RADS, K=1000 MICROFARADS.

MAIN SCHEMATIC

KEPCO INC.
FLUSHING, N.Y.

TITLE			
SCHEMATIC			
DRAWN	CHECKED	APPROVED	DATE
I.I.			8.8 66
MODEL NO.		PART NO.	SCALE
V.I.P.-3			
DWG. NO. CM02692			

S ± 1/64 DECIMALS ± .005 ANGLES ± 1/2°

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK